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CONTROL OF *Trogoderma granarium* THROUGH OF GAMMA RADIATION OF COBALT-60

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Abstract

Trogoderma granarium belongs to the Coleopteran order, its common name kharpa beetle and is a pest of stored-products. Kharpa beetle actually it is find in Brazil, and is an important pest from importers and exporters of stored-products. Questions regarding the safety of chemical treatments for quarantine purposes have led to renewed interest in the use of radiation to disinfestation as a quarantine treatment. The objective of this work was study the effect of different doses of gamma radiation of Cobalt-60 to control of adults of *T. granarium*. The adult insects were irradiated in a Cobalt-60 source type Gammabeam-650, with doses of 0 (control), 25, 50, 75 and 100 Gy, with a dose rate of 313,78 Gy/hour. Each treatment had 3 repetitions with 10 adult insects each, in a total of 30 insects for treatment. After the irradiation the experiment was put in a climatic camera with temperature of 22°C and relative humidity of 70%. The mortality counting were accomplished every 7 days, and after mortality of the all adults was done the evaluation of the emergence of the filial generation (F_1). The results show that the dose of 100 Gy was the sterilizing for the adult insects. As we know a sterile population is an extinct population then we can indicate with safety a dose of 100 Gy to control this pest in stored products. But for safety and in agreement with the results found in the literature a dose of 200 Gy is recommended.

Key-words: Control, *Trogoderma granarium,* gamma radiation, stored-products

1. INTRODUCTION

Methyl bromide (MB) the most widely used fumigant to control insects in food and agricultural commodities, is being phased out globally in the near future. Agricultural products and food that are possibly infested by quarantine pests need an alternative method for agricultural products and food. There are considerable data on irradiation as a quarantine treatment against tephritid fruit flies, but little data on the use of this technology against other arthropod pest of quarantine importance.

Questions regarding the safety of chemical treatments for quarantine purposes have led to renewed interest in the use of radiation disinfestations as a quarantine treatment. Many species of stored-product pests are cosmopolitan, but other serious pests such as the khapra beetle (*Trogoderma garanarium*) , the larger grain borer (*Prostephanus truncates*), and various species of legume weevil (Bruchidae) are not. Traditional quarantine treatments are designed to produce rapid mortality, but irradiation is only minimally effective in this regard. However, irradiation is very effective in preventing insect development and in producing sterility. Irradiation has been proposed as a quarantine treatment for various species of fruit flies, mango weevil and codling moth but not for stored product pests [3]. And in products irradiated for quarantine purposes, it must be ascertained that still living insects are not able to survive or proliferate in a new location [8].

Among stored-product pest, khapra beetle, *Trogoderma granarium* Everts is a high priority pest. This beetle is a serious quarantine pest that occurs on stored cereals and cereal products, dried fruit, nuts and a rather wide variety of foodstuffs. It can complete destruction of grain and pulses in a short time under hot, dry conditions. The larvae can diapause for two to eight years under unfavorable conditions. Chemical control of the khapra beetle with both contact insecticides and fumigants is difficult [6]. All life stages infest the commodity. Because this beetle has limited mobility, it spreads principally through the agency of man [4]. From the experimental results and literature investigation, irradiation doses as low as 48 Gy prevented egg hatch; and 60 Gy prevented the development to pupae for young larvae and 100 Gy for old larvae and diapausing larvae. No successful reproduction was found after irradiating older larvae, pupae, and adults of khapra beetle with a dose of 200 Gy; therefore, the effective quarantine irradiation dose for khapra beetle was 200 Gy [5]. Khapra beetle is considered an important quarantine pest in Brazil, and is often intercepted at the ports on entry [2].

An effective irradiation quarantine treatment results in suppression of the F1 generation based on an inability to reproduce or non-completion of development of immature stages for khapra beetle and others insects [7, 1] . The objective of this work was study the effect of different doses of gamma radiation of Cobalt-60 to control adults of *T. granarium* in wheat flour.

2. MATERIAL AND METHODS

The khapra beetle colony used in this research was started from the individuals collected in wheat flour. The pest insect was reared in Laboratory of Irradiation of Food and Radioentomology of Center Energy Nuclear in Agriculture, University of São Paulo, Piracicaba, city, Brazil. The pest was reared with broken wheat in 12x20x5cm enamel trays covers. The trays were kept in a climatic camera at temperature of 25°5C and 70±5% RH. Adults insects with ages of 5 days after emergence were irradiated with doses of : 0 (control), 25, 50, 75 and 100 Gy, with a dose rate of 313,78 Gy/hour, in a Cobalt-60 source type Gammabeam-650. Each treatment had 3 repetitions with 10 adult

insects with undetermined ages, in a total of 30 insects for treatment. After irradiation was evaluation the mortality and emergence of generation F1. For statistics analyses of the results the test of Tukey was utilized.

3. RESULTS AND DISCUSSIONS

The irradiation effects on adults and the emergence of F1 generation are shown in Table 1, There was no obvious difference in mortality between treated and untreated adults after 7, 14, 21 and 28 days after irradiation, but in dose of 100 Gy, we can observe that the mortality was accentuated in relation other treatments. The treatment control after 14 days all the insects were dead and in the treatments with radiation are not. The emergence of adults in the generation F1 was obtained until the dose of 75 Gy. The dose of 100 Gy was considerated sterility for adults of khapra beetle, As we know a sterile population is an extinct population then we can indicate with safety a dose of 100 Gy But for safety and in agreement with the results found in the literature a dose of 200 Gy can be recommended to control this pests in stored-products.

Table 1. Medium number mortality of adults insects *Trogoderma granarium* after 28 days(in a period of every 7 days) of irradiation and emergence of generation F_1.

Dose Gy	Total number of irradiated insects	Mortality of insects 7 days after irradiation	Mortality of insects 14 days after irradiation	Mortality of insects 21 days after irradiation	Mortality of insects 28 days after irradiation	Emergence of adults insects in generation F_1
0	10	4.3a	10.0a	10.0a	10.0a	163.3a
25	10	5.6a	9.3a	9.0a	10.0a	25.6b
50	10	5.0a	9.3a	10.0a	10.0a	22.0b
75	10	5.0a	7.6a	9.6a	10.0a	1.0c
100	10	6.0a	9.0a	9.0a	10.0a	0.0c

Averages with the same letter differ amongst themselves at the level of 5%.

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